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ETI HDV Marine Programme

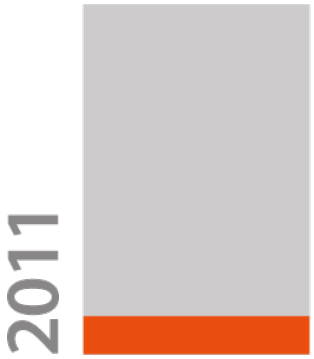
Dr. Stuart Bradley

ETI10 TEN YEARS OF INNOVATION 2007 – 2017

THE AIM OF THE HDV MARINE PROGRAMME

To bring about a meaningful change to the fuel efficiency and Green House Gas intensity of the UK HDV marine fleet

Why is HDV efficiency so important?

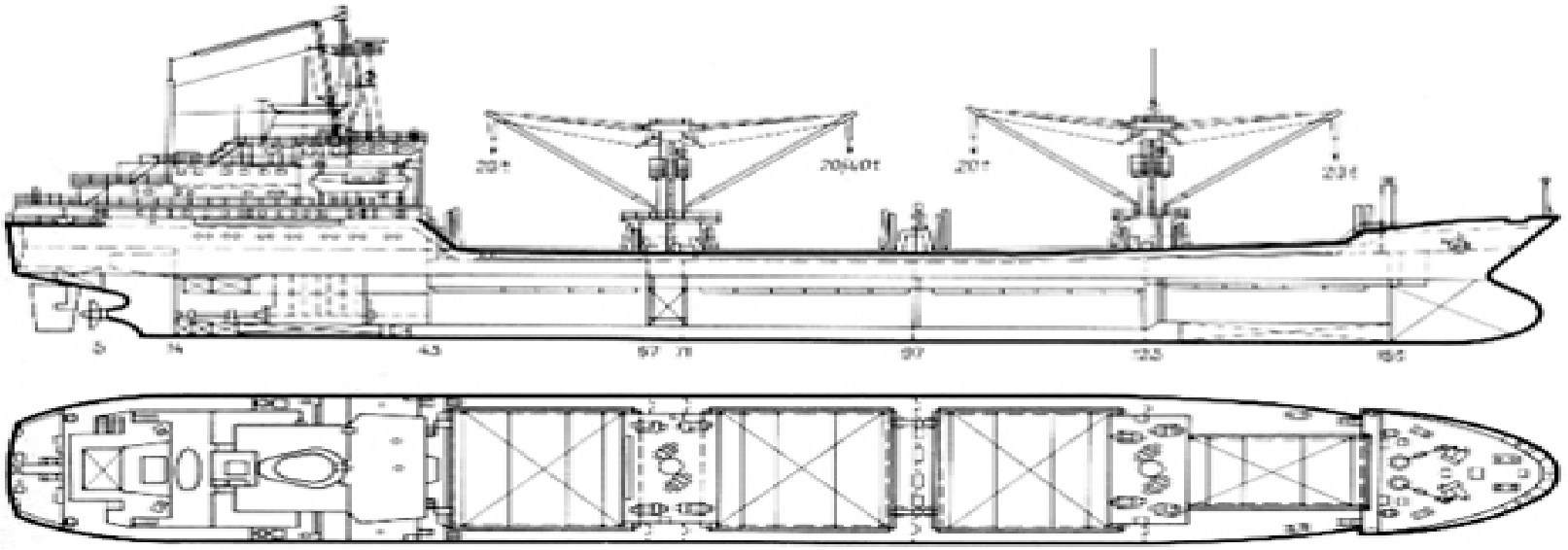


8% of current UK CO_2 emissions are from HDVs

Proportion is set to increase to approx 30% as other sectors reduce CO_2

- Modelled scenarios consistently point to HDV efficiency as cost-effective way to reduce emissions
- Limited options for low-carbon fuel alternatives

Ship Construction and Lexicon

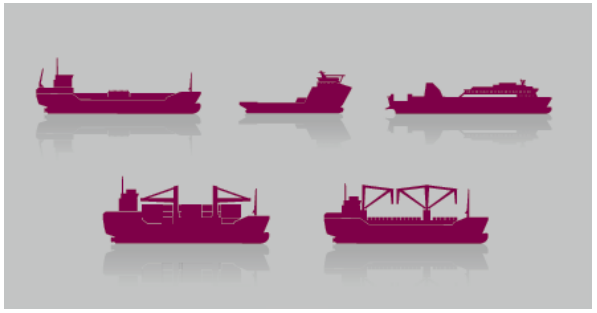


- Propeller
- Rudder
- Funnel
- Bilge
- Double-bottom

- Aft Peak
- Poop Deck
- Fo’c’sle
- Bulbous Bow
- Stern
- Forepeak

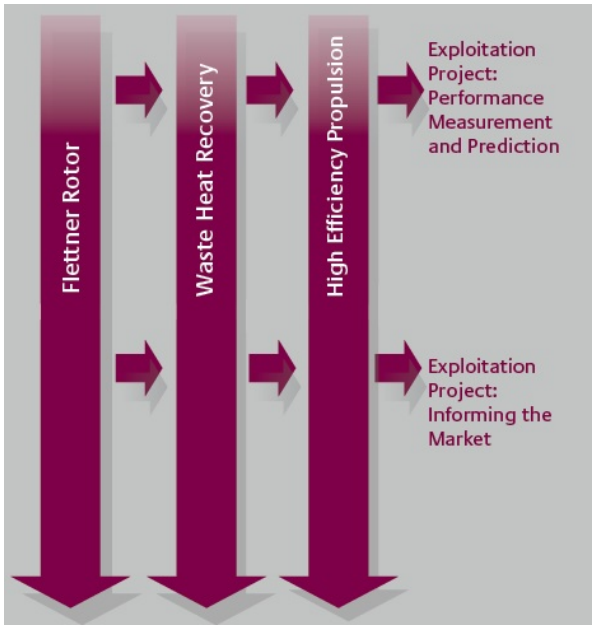
Marine Programme Structure

Phase 1 – Market Understanding & Concept Engineering



2 Separate parallel projects undertaken both aimed at establishing the UK fleet structure, CO_2 breakdown and identifying fuel efficient technologies (completed)

Phases 2 / 3 – Sub-system development, integration and demonstration

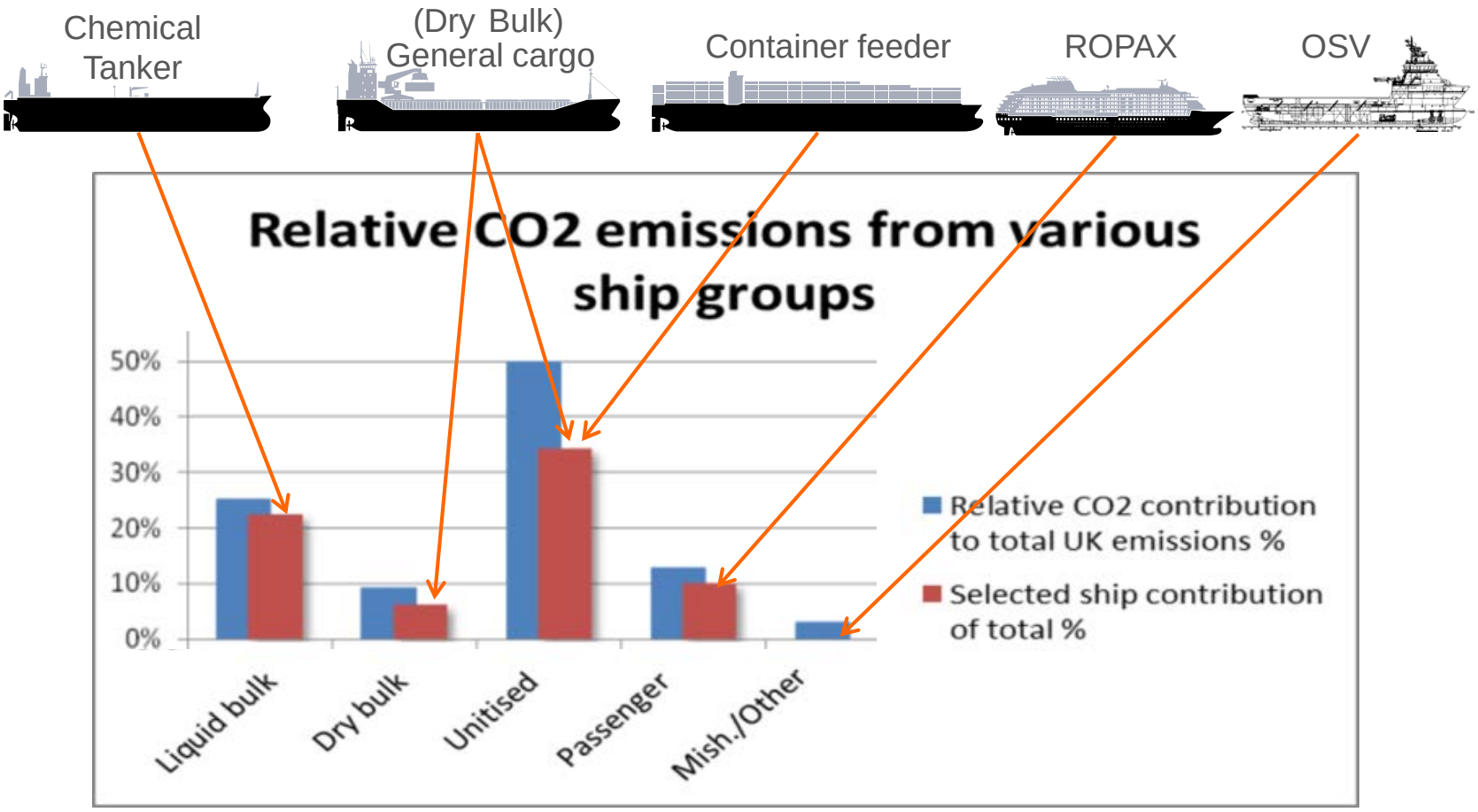


3 technology development projects:
- Flettner Rotors
- Waste Heat Recovery
- High Efficiency Propulsion

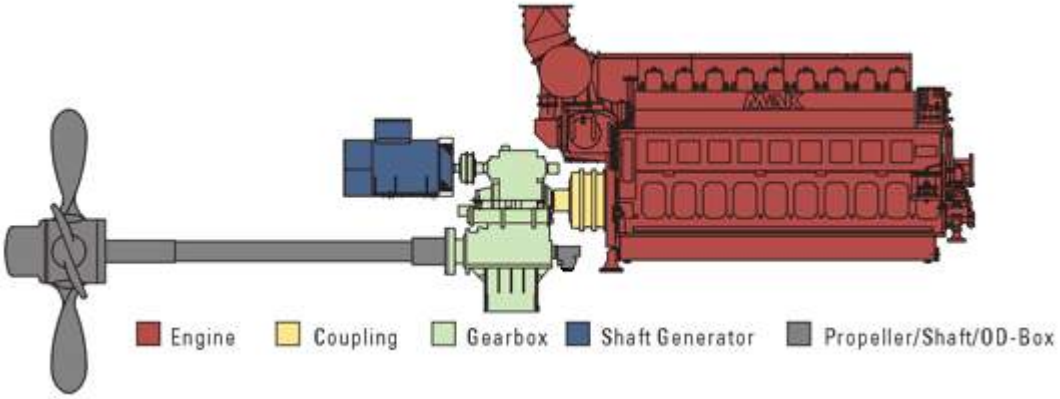
Supported by two projects aimed at modelling / demonstrating fuel efficiency benefits for specific vessel arrangements and how best to communicate this to the stakeholders

What is our UK Fleet?

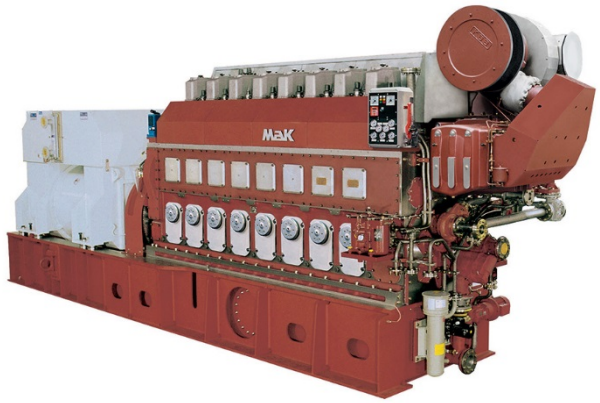
Selected vessels to represent the HDV marine fleet



What do Ships use for Power Today?

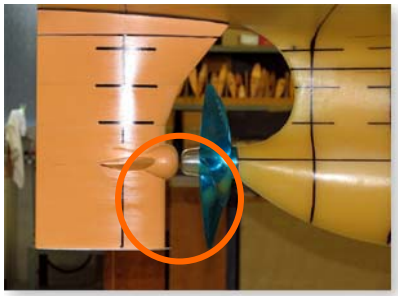


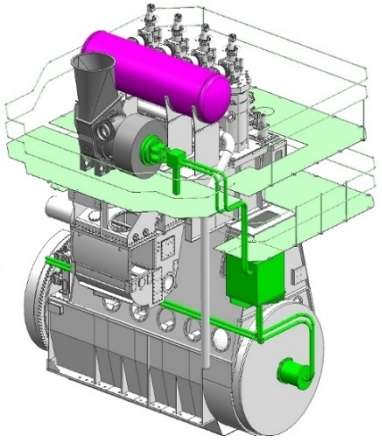
Propulsion Driveline

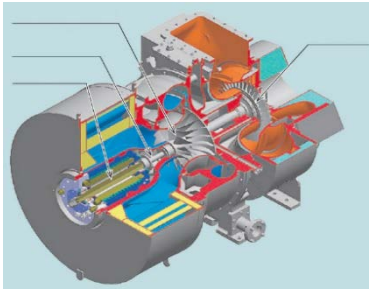


Electrical Power

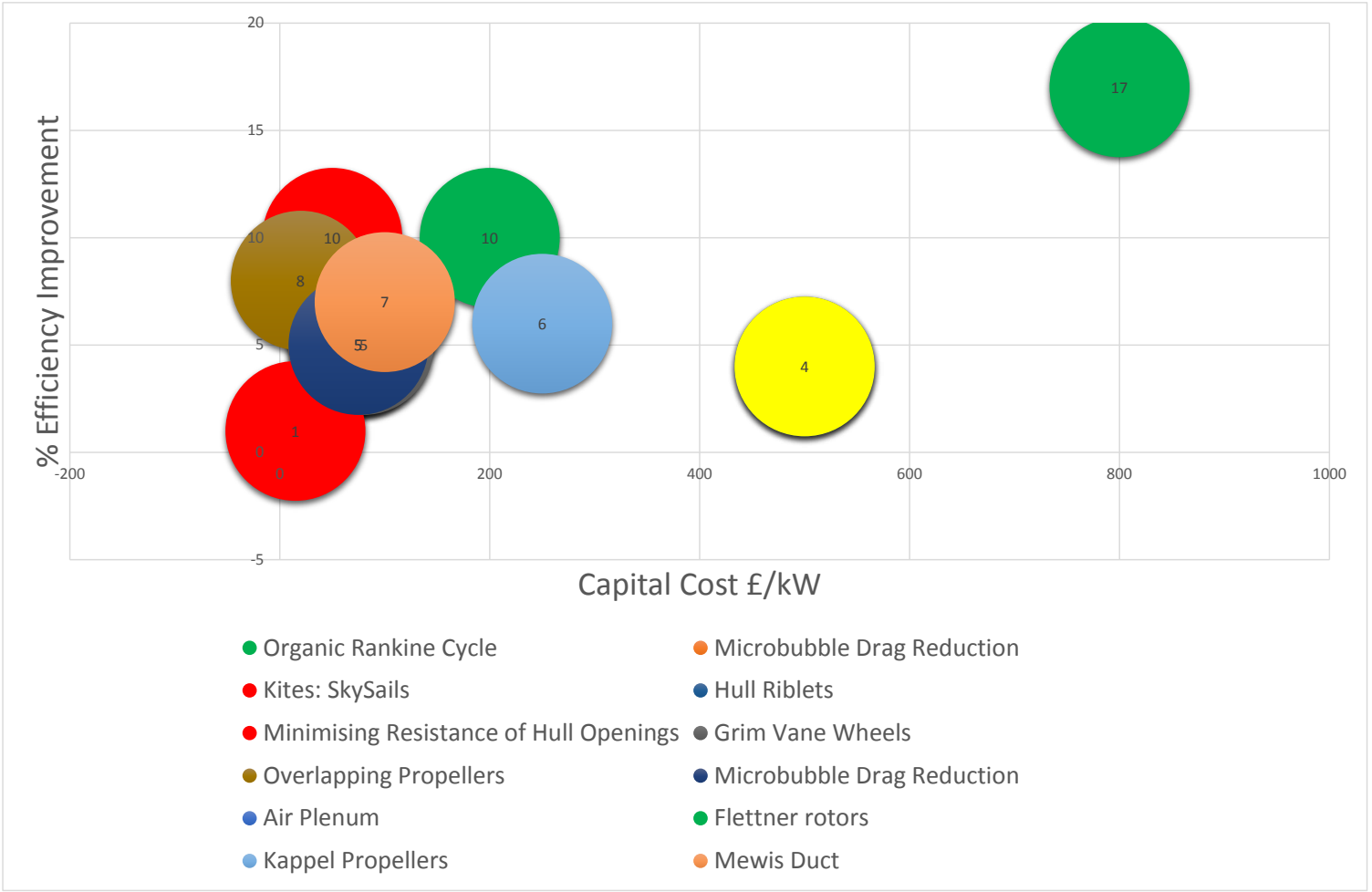
Innovations for Ships



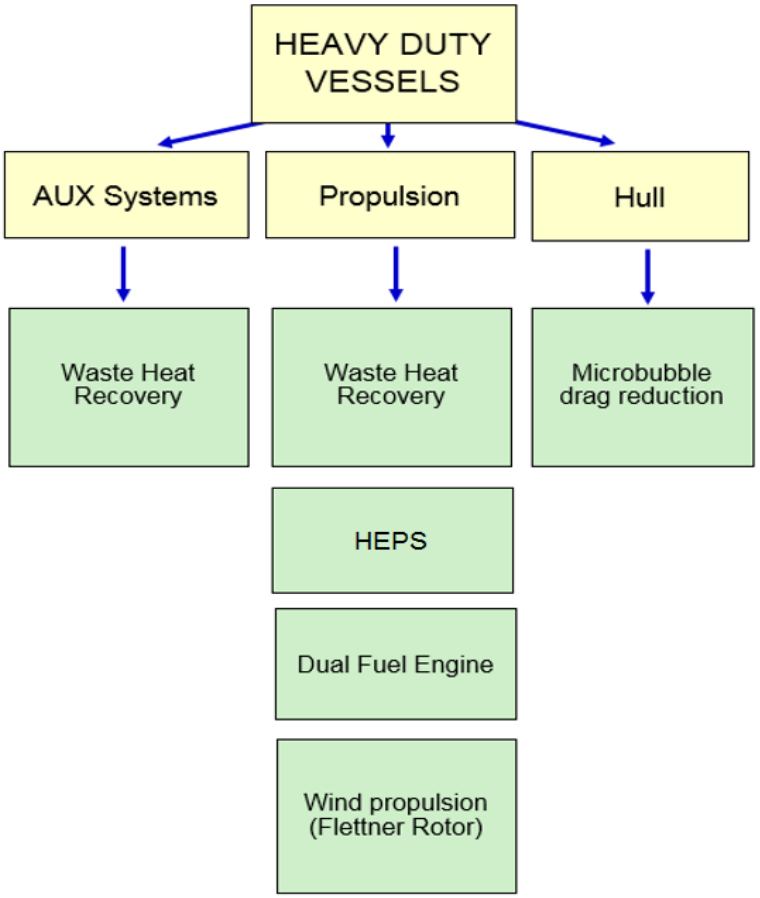




Technology Impact

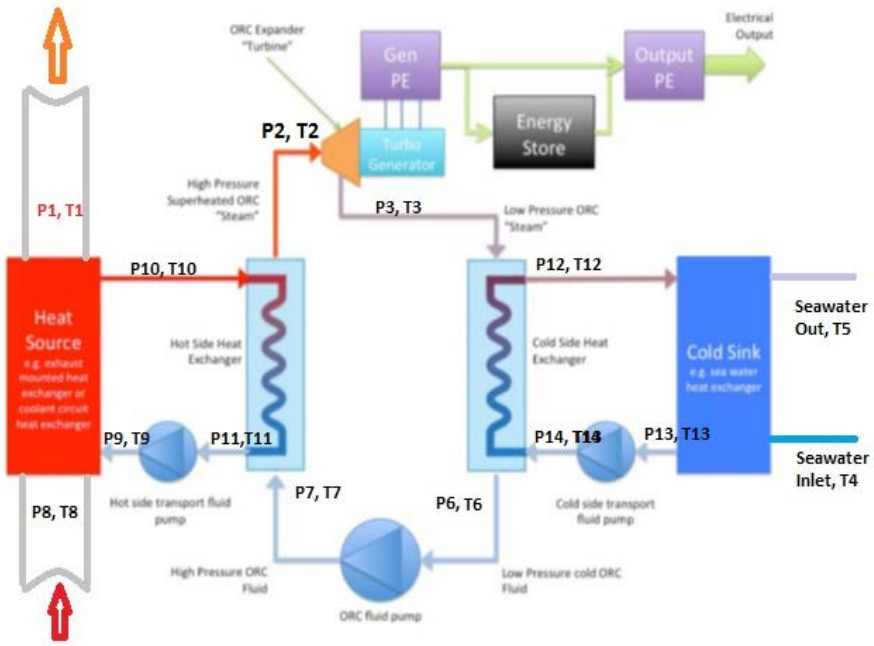


Improved performance



Waste Heat Recovery

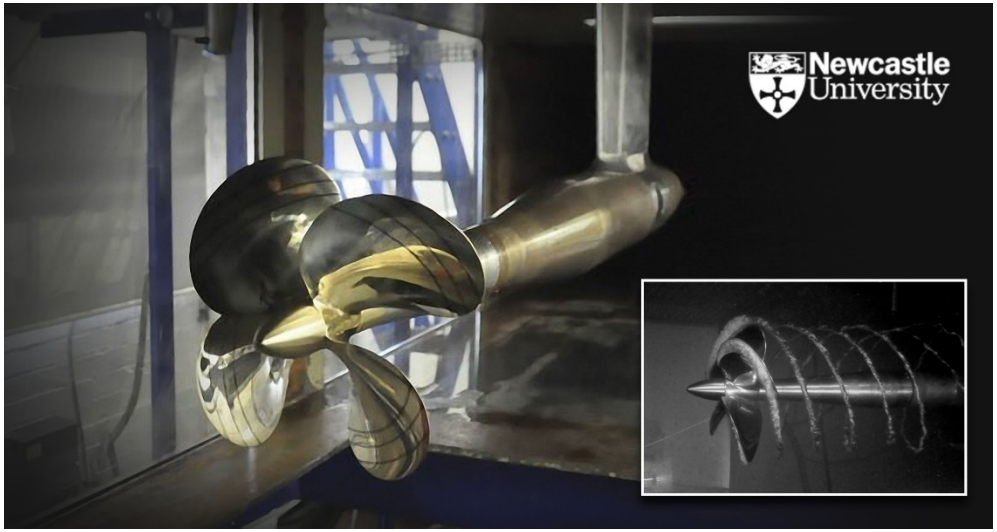
- £4.5m contract with Avid Technology Ltd
- Uses heat from the main and auxiliary engines, and converts to electrical energy
  - “Reverse Fridge”
  - Circa 150kWe
  - Classification Society approved
- Electrical energy can be fed
  - Back to the propeller driveline
  - Into the electrical system



High Efficiency Propulsion System Project (HEPS)

- £3m project cost
- Contract with Teignbridge Propellers International, Devon

- Three core technologies
  - Advanced hydrodynamic design
  - Shape shifting
  - F1 pit-stop style changes



Flettner Rotor System

- £3.5m Contract with Norsepower Oy of Finland with partners Maersk Tankers and Shell Shipping
- Flettner Rotors convert wind energy into propulsion thrust

Twin-Rotor FRS, 30m High, 5m Diameter

Fully integrated into the ships power and propulsion systems

HDV Marine Insights Paper Published January 2017

The International Maritime Organisation states that, without intervention, maritime emissions could rise by

50 - 250%

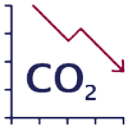
by 2050 compared to 2011 levels

The greatest CO_2 emissions come from three ship types –

tankers, bulk carriers and container ships

TARGETING A 30% IMPROVEMENT IN FUEL EFFICIENCY FOR MARINE VESSELS

Eliminating fossil fuels for shipping does not appear credible – the best potential to achieve substantial CO_2 reduction in the next few decades is through reducing fuel consumption



The ETI believes

30%

fleet fuel consumption reduction can be achieved by using innovative technologies with an economic payback of around two years

New technology introduction is challenging, costly and risky so

fuel-saving technology

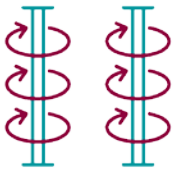
demonstration is needed to give confidence and overcome market barriers

ETI is advancing

marine technology

demonstration in Flettner rotors, high efficiency propulsion systems and waste heat recovery

Flettner rotors



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